A Wireless Speed Control of Three Phase Induction Motor

[1]lalita Singh, [2]shimi S.L

[1]*Eshan College Of Engineering, Farah-Mathura, India*
[2.] *A.P., N.I.T.T.T.R, Chandigarh, India*

Abstract:-
Induction motors are the widely used motors in largely power-driven home appliances, agricultural and industrial applications. Induction motors are largely used because of its advantages such as Simple and rugged design, low cost, low maintenance and direct connection to an AC power source. Many applications need variable speed operation and one of them is a simple fan load. The main aim of the this paper is to design an real time electronic control system that can be used to control the speed of motors kept at remote locations using an embedded technology. This paper describes about speed monitoring and controlling of induction motor with the help of wireless technology. In the proposed system speed of three phase induction motor can be controlled i.e., speed can be increased or decreased by either increasing or decreasing the pulse width with the help of microcontroller. In addition to this measured speed can be send wirelessly at a distant location for the display.

Keywords — *: Induction motor, transducer, h-bridge , AND GATE, Bridge rectifier.*

I. INTRODUCTION

In the present time, in most of the application AC Machines are preferred over DC machines due to their simple and robust construction without any mechanical commutators. Induction motor is most commonly used ac motor for appliances such as industial control and automation thus often called as workhorse of motion industry. Induction motor is used to drive mechanical systems in industries like paper mill, sugar industry and cement industries.Three phase induction motors are admirably suited to fulfil the demands of loads requiring substantially a constant speed. Several industrial applications however need adjustable speed for their efficient operation and improvement of quality product. Earlier DC motor was the choice for variable speed drive application inspite of various disadvantages. Due to progress of semi-conductor Technology and advent of Microcontroller has transformed the research and development towards control of AC drives. Speed of three phase induction motor can be controlled in various ways:

(i)By changing the number of poles.
(ii)By controlling supply voltage.
(iii)By v/f control or frequency control.

In the proposed system speed of three phase induction motor can be controlled i.e, speed can be be increased or decreased by either increasing or decreasing the pulse width with the help of microcontroller. In this system we are modulating the width of pulse in order to control the speed of induction motor. This method is called pulse width modulation.PWM is a common technique to control the speed which avoids the problem of poor starting performance of a motor.

II. FUNCTIONAL BLOCK DIAGRAM

The proposed system consist of two modules

A. Measuring Module.
B. Display Module.

Measuring module

This module is used placed near induction motor for the purpose of measurement. The block diagram in the Fig.2 shows measuring module for the measurement of speed of induction motor wirelessly with microcontroller. Each block is explained separately.

Display Module

The module is placed at some distance .This is used to display the measured speed of induction motor on the PC. The Fig.1 shows the components of Display module.

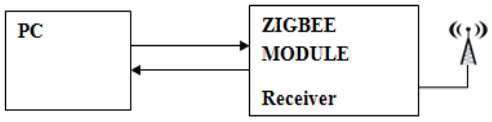

Fig. 1 Display Module

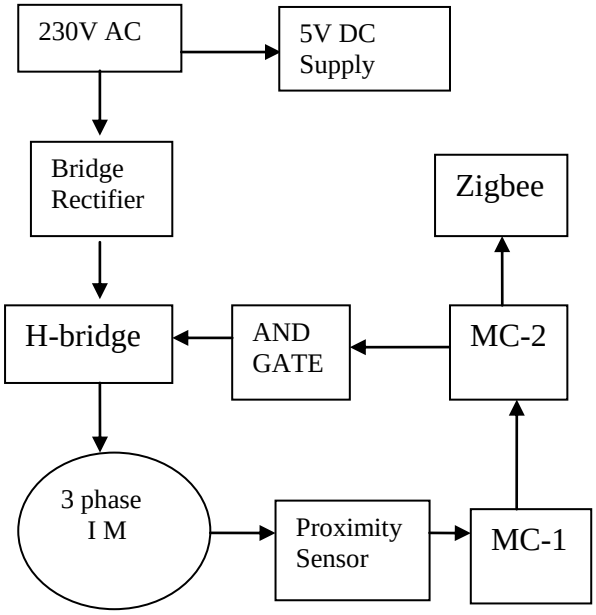

Fig. 2 Measuring Module

III H- BRIDGE

The fig. 3 shows the circuit diagram for H-Bridge. H-Bridge topology is wiely used the field of power converters and motor drives. It is because half bridge has the capacity to provide efficient control of a pulse. Both IGBTs are operated in a mutually exclusive fashion because if both were conducting at once shoot through would occur. In the proposed system we are using three Half H –Bridge of IGBTs for the generation of three phase in order to drive the three phase induction motor. IR2101IC is used to as H-Bridge driver to drive IGBT.

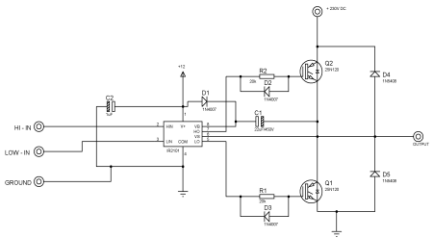

Fig. 3 H-Bridge

IVPROXIMITY SENSOR

The induction motor speed is measured using proximity sensor which is connected to the shaft of the motor. Microcontroller AT89C51 is used to measure speed AT89C51 start 1sec delay then count all the pulses through proximity sensor by using timer/counter0 and multiply with 60 and then send to atmega16 which is then displayed on personal computer. on personal computer. . In addition to this speed can be increased or decreased as per the requirement from distant location.

V MICROCONTROLLER UNIT

As the microcontroller is the core of the proposed system, the project was started by choosing the suitable microcontroller for it. MC-1 is AT89C51.AT89C51 is a low power, high performance 8 bit microcomputer having 4 k bytes of In-System Programmable flash memory. The on-chip flash allows the program memory to be reprogrammed in system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, it provides a highly-flexible and cost-effective solution to this project Memory. AT89C51 microcontroller is used for reading speed of the motor. Another microcontroller used in this project is ATMEGA16, It is used as MC-2.ATMEGA16 is a low power CMOS 8bit microcontroller based on RISC architecture .It has 16K bytes of In System Programmable Flash memory with read while write capabilities as compared to 8051 which has 4k bytes of ISP flash memory. It has 32 general purpose working registers directly connected to ALU, allowing two independent registers to be accessed in one single instruction executed in one clock cycle the on chip ISP flash allows the program memory to be re- programmed in-system through an SPI serial interface. It has four PWM (pulse width modulation) channels, 8 channel 10 bit ADC.ATMEGA16 with AND gate is used to transfer pwm signal towards positive or negative cycle.It is also used for sinusoidal pulse width modulation.

VI BRIDGE RECTIFIER

H –Bridge uses dc input. To convert ac to dc Bridge rectifier is used. A bridge rectifier is an arrangement of four or more diodes in a bridge circuit configuration which provides the same output polarity for same input polarity. The primary application of bridge rectifier is to transform an ac supply into dc power .Bridge rectifiers are mainly classified into single and three phase rectifiers. The main advantage of bridge rectifier is that it produces almost double the output voltage as with the case of a full wave rectifier using centre tapped transformer.

VII AND GATE

AND gate is a logical gate which is widely used having two or more inputs and a single output. AND gate is used to perform multiplication operation of binary digits 1 and 0 and operates on logical

multiplication rule.Output of AND gate is used to drive is output is used to drive H-Bridge for positive and negative cycles.

VIII AND GATE DRIVER MODULE

Fig.4 shows the circuit diagram for driving AND gate which is used to transfer pwm signal toward positive or negative cycle.In this ATMEGA 16 three pwm channels are used for three phase pwm cycle. In the proposed system we are using 6 AND gates. Logic 0 and logic 1can be applied to AND with programming. The output from AND gates are used to drive IGBT of H-Bridge.

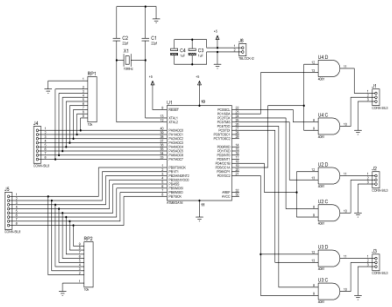

Fig.4 AND Gate Driver

CONCLUSIONS

The developed system can be used to monitor the speed of induction motor wirelessly using zigbee .Also the measured speed can controlled to the desired speed required for the application. The developed used for industrial application.

REFERENCES

[1] R.R Patil, T.N Date and B.E Khushare. "Zigbee Based Parameter Monitoring System for Induction Motor," *IEEE Students Conference on Electrical, Electronics & Computer Science.*Bhopal, March 2014.

[2] Arun Nadh and Lakshmi Praba.N."Automatic Speed and Torque Monitoring in Induction ting, Motors using Zigbee and SMS,". *International Conference on Emerging Trends in Computing, Communication & Nanotechnology*, Tirunelvelui, March 2013.

[3] Fang Duan and Rastko Zivanovic. "Condition Monitoring of an Induction Motor Stator Windings via Global Optimization based on the Hyperbolic Cross Points,". *IEEE Transactions on Industrial Electronics, Vol 62, No.3*, March 2015

[4] Mahendra P.Bodkhe and K.N Pawar. "Parameter Monitoring Using Zigbee Protocol for Three Phase Induction Motor",. *International Journal of Emerging Technology and Advanced Engineering, Vol.1*, January 2014.

[5] Pinjia Zhang, Yi Du, Thomas G Habetler and Bin Lu."A Survey of Condition Monitoring and Protection Methods for Medium Voltage Induction Motor,". *IEEE Transactions on Industry Applications, Vol47, No.1*, November 2011.

[6] J. Pedro Amaro, Fernando J.T.E. Ferreira,, Rui Cortes˜ao,,Nelson Vinagre_ and Rui P. Bras.Low Cost Wireless Sensor Network for In-Field Operation Monitoring of Induction Motors. *IEEE International Conference on Industrial Technology (ICIT) Viadel*,, March 2010